RECREATIONAL SPORTS AS A STRATEGY FOR ANXIETY REDUCTION IN ADOLESCENT STUDENTS

Valeria BĂLAN[1], Cornelia MIHALCEA[2], Georgeta MITRACHE[1], Ana Maria MUJEA[1*], Dimitra KOUTSOUKI[3], Katerina ASONITOU[3], Sophia CHARITOU[3], Camelia BRANEȚ[4]

[1] National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania
[2] Middle School no. 39, Bucharest, Romania
[3] National and Kapodistrian University of Athens, School of Physical Education and Sport Science, Laboratory of Adapted Physical Activity/Developmental and Physical Disabilities, Greece
[4] Politehnica University, Department of Physical Education and Sports-Kinetotherapy, Bucharest, Romania
*Corresponding author: mujeaanamaria@yahoo.com

https://doi.org/10.35189/dpeskj.2025.64.4.4

Abstract. *Anxiety is the most common and universal human emotion. It is a reaction of tension without an apparent cause, but more diffuse and less focused than fear. Anxiety, as a normal emotional sensation or state in certain circumstances, is a typical response to various stressful everyday situations. The problem arises when anxiety occurs continuously over time in situations that are not really threatening or when it is very intense. The present research aims to identify the role of recreational sports activities in combating anxiety among eighth graders. The study focuses on this category of students for two reasons: on the one hand, the demands placed on them throughout the school year because of the evaluation exam, which is particularly important for their school and even professional careers, and on the other hand, because most studies highlight the benefits of sports participation for adolescents in general, while our approach is aimed at 14-15 year olds who are preparing for an essential stage in their lives. The research involved a group of eighth graders from a mainstream school in Bucharest. The main tool used was the Spence Children's Anxiety Scale. It was completed by adolescent before and after application of the intervention programme lessons. The initial anxiety score (62.75 points) suggested a risk for anxiety disorder. After completion of the sports activity programme, the overall level of anxiety was within normal limits. This study has demonstrated that recreational sports activities have beneficial effects on anxiety disorders.*

Keywords*: human emotion; Spence Children's Anxiety Scale; sport activity programme; recreational sports lessons.*

Received: *30 March 2025* / **Accepted:** *15 December 2025* / **Published:** *30 December 2025*

Copyright: © 2025 Bălan, Mihalcea, Mitrache, Mujea, Koutsouki, Asonitou, Charitou and Braneț. *This is an open-access article distributed under the terms of the Creative Commons Attribution (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms*

Introduction

Anxiety is a common human emotion, defined as a diffuse state of tension that is less specific and less focused than fear, often occurring without an immediately identifiable cause. Anxiety, as a normal emotional sensation or state in certain circumstances, is a typical response to various stressful everyday situations. Therefore, some degree of anxiety is quite desirable for the normal management of daily demands.

Anxiety is an adaptive response necessary for the proper functioning of an individual; it is an emotion that appears in ambiguous situations where a possible threat is anticipated, thus preparing the person to produce cognitive, physiological and behavioural reactions to such events. Anxiety has the function of warning and activating the body in uncertain, threatening, dangerous situations. When danger is perceived, psychophysiological activation occurs in order to facilitate the fight-or-flight response and thus protect the individual (Ezpeleta et al., 2001). This response is accompanied by physiological changes such as increased heart rate, blood pressure, respiratory rate, and muscle tension, along with heightened sympathetic activity (e.g., tremor, polyuria, diarrhoea). They are normal responses to stressful situations (Antony & Stein, 2008).

The problem arises when anxiety persists over time in non-threatening situations (i.e., when there is a disproportion between the response and the actual threat) or when it becomes excessively intense. Anxiety becomes problematic because of the interference, discomfort and distress it causes in a person's life. The focus of this anxiety can be variable, resulting in various disorders (Ezpeleta et al., 2001).

When it exceeds certain intensity or the coping ability of a person, anxiety becomes pathological, causing major discomfort due to symptoms that affect physical, psychological and behavioural well-being (Antony & Stein, 2008; Graupensperger et al., 2021). Pathological anxiety is persistent, extensive, disproportionate to the threat and incompatible with reasoning, which leads to significant distress and poor functioning in different contexts relating to school, family, peers, etc. (Chiu et al., 2015).

Most anxiety disorders that are diagnosed in adults begin in adolescence (Bang et al., 2024; Clément et al., 2024; Graupensperger et al., 2021) and are associated with a range of other negative mental health and life course outcomes (Woodward & Fergusson, 2001).

Although very widespread, anxiety often goes unnoticed and therefore remains untreated (Sawyer et al., 2019). When properly diagnosed and treated, this disorder can be reduced with aging. However, adolescents often lack the necessary resources and coping strategies to manage stressful situations effectively. Because many adolescents do not ask for support from parents or professionals, they may resort to maladaptive coping mechanisms such as alcohol, tobacco, or substance use (Merikangas et al., 2011). Gradually, this behaviour generates a vicious cycle where larger amounts of substances are needed to manage symptoms. If the use of these substances persists over time, it can lead to numerous negative consequences that affect both the school performance and the behaviour of adolescent students (Woodward & Fergusson, 2001).

Many adolescents and young people experience symptoms such as somatic symptoms, school-related fears, shyness, insecurity, or lack of social skills (Essau et al., 2012). They try to cope with these issues as well as possible, doing the best they can and/or hoping that it will be temporary and the symptoms will disappear over time. Nevertheless, they are often unaware that these may indicate anxiety or depressive disorders. Reality shows the negative impact of anxiety disorders on school performance, family life, and recreational sports activities in affected children and adolescents.

However, anxiety disorders can be successfully managed: the earlier they are detected and treated, the more likely it is that this condition will be resolved. For this, a number of mental health programmes including different psychological techniques are used: relaxation

techniques, self-control techniques, self-reinforcement, self-observation, problem-solving techniques, anxiety management, counselling techniques, brief family therapy, etc. (Antony & Stein, 2008).

Exercise in the form of various sports activities is recommended to be associated with these programmes. Participation in physical exercise is beneficial to the nervous system, enhancing resilience to anxiety-inducing stimuli (White et al., 2024). At the same time, they increase self-esteem (White et al., 2024; Bae et al., 2024; Doré et al., 2020; Dale et al., 2019), induce a sense of well-being and improve health (Chi & Wang, 2022). These benefits are further reinforced by the sociocultural context of sports participation.

Sports activities can be played individually or in groups, as recreational games or sports games. These games are extremely valuable because they offer participants freedom of action, the opportunity to express their own choices, take the initiative, exploit their creativity at high levels and assume roles that can highlight their skills (Mocanu, 2018).

Participation in recreational sports activities or elite sports (Panza et al., 2020) has a beneficial effect on adolescents in their formative years, as they are constantly concerned with their social affirmation. Involvement in such activities helps them discover and develop their social skills, and peer support and acceptance (Bang et al., 2024) foster the process of personal and social affirmation (Feng et al., 2024). However, changes in physical appearance can increase adolescents' vulnerability to prejudice, stereotypes or comments from others (You et al., 2021).

In order to achieve the goals regarding the active participation of adolescents in physical and/or recreational activities, their prior training is required within an instructional-educative process. Thus, physical education teachers should focus on identifying effective teaching methods that stimulate students' engagement in physical activity. This approach can increase participation in independent physical exercise during leisure time (Tudor et al., 2025). The extracurricular setting also outlines the preventive role of physical activities in the development of anxiety disorders (Mc Dowell et al., 2018; Petzold et al., 2020) among boys and girls who experience greater sensitivity to anxiety and lower levels of physical activity (DeWolfe et al., 2020). Therefore, the teacher should create, through a multidimensional approach, a motivational climate that contributes to reducing anxiety levels (Melguizo-Ibáñez et al., 2022).

In Romania, a major demand arises against the background of age-specific morphological and functional changes, namely the National Evaluation of eighth-grade students. It aims to verify their skills acquired during lower secondary education. The exam is held in a single session at the end of the school year and consists of two tests, one in Romanian language and the other one in mathematics. The final average score achieved in the two tests is the basis on which assignment to high schools is made. Students and their parents complete an application form, marking the high schools where they wish to continue their studies. Depending on the final score obtained in the National Evaluation and the choices made, the computer assigns students to high schools (*Ministerul Educației și Cercetării* [Ministry of Education and Research], 2024).

The National Evaluation exam is extremely important because the final score influences the student's school career in the next four years (upper secondary education) and even their future university studies and professional activity. For this reason, students may be very stressed by parents, who may put a lot of pressure on their children so that they succeed in studying at the

best high schools and also by teachers, who want them to achieve good scores for both their personal prestige and the school's prestige. Under these conditions, if students do not receive emotional support, are not engaged in open discussions, and are not provided with stress-relief activities, they become anxious and depressed (Li et al., 2021), and some of them even have unsatisfactory results despite being very good students.

The decrease in school performance has negative consequences on the adolescent's self-esteem (Li et al., 2021) and can lead to the development of anxiety disorders. If anxiety is intense, the student shows excessive sensitivity and fears (Merikangas et al., 2011), is afraid of being disliked by others, has the impression that peers laugh at them and is reluctant to activities that other students do with enthusiasm. A state of intense anxiety makes the adolescent easily disturbed by everyday life experiences and especially by schoolwork, since they exhibit different behaviour and school performance compared to the other classmates (Ezpeleta et al., 2001).

Physical activity, in addition to its multiple benefits for all people regardless of their ontogenetic category, contributes to reducing anxiety (Bouchard et al., 2012; Ma et al., 2009; Martinsen, 2008; Qin, 2024, Rahmati et al., 2024). The study conducted by Guthold et al. (2019) demonstrates that 81% of adolescents (11- 17 years old) are physically inactive, and thus the recommendations of the World Health Organization (WHO) regarding physical activity standards are not respected. Global guidelines (WHO, n.d.) for children aged 5-17 recommend at least an average of 60 minutes per day of moderate-intensity (60-74% of HR_{max}) to vigorous-intensity (75-85% of HR_{max}), mostly aerobic physical activity, which, as part of well-structured and well-planned programmes lead to a decrease in anxiety levels (Bouchard et al., 2012). The positive effects of anaerobic exercise (Wipfli et al., 2008) used in physical activity programmes or even outdoor activities are also mentioned (Lawton et al., 2017).

The study by Oeland et al. (2010) suggests that, in certain cases of depression and anxiety, reaching the recommended levels of physical activity can help reduce the symptoms of these mental disorders, therefore the need to expand skills in order to facilitate the implementation and promotion of physical activities among the population is supported.

Methodology

Scope

The present research aims to identify the role of recreational sports activities in combating anxiety among eighth graders. The study focuses on this category of students for two reasons: on the one hand, the demands placed on them throughout the school year because of the evaluation exam, which is particularly important for their school and even professional careers, and on the other hand, because most studies highlight the benefits of sports participation for adolescents in general, while our approach is aimed at 14-year-olds who are preparing for an essential stage in their lives.

Objectives and tasks

- To understand the characteristics of anxiety in students aged 14–15;
- To develop a psycho-pedagogical intervention program aimed at reducing anxiety levels through recreational sports activities;
- To assess the effectiveness of applying this program to the research participants;
- To identify the significance of engaging in recreational sports activities among the research participants, students aged 14–15.

Research question

What are the benefits of recreational sports activities on the prevention and reduction of anxiety levels in eighth-grade students?

Participants

The research involved a group of eighth graders from a mainstream school in Bucharest. Most of the investigated adolescents (aged 14-15) had been classmates for over 7 years, had already established long-term peer relationships, and had enjoyed participating in various school activities. It should be noted that not all students in this group took part in the research, some of them refusing from the beginning to get involved in the programme, while others were eliminated during the intervention. Participants were excluded due to factors such as individual preparation for the National Evaluation exams, parental constraints related to household activities, absence from the intervention programme lessons, occurrence of medical problems that prevented them from continuing the programme, playing a sport at a competitive level, personal involvement in other recreational activities within private clubs, etc. Under these conditions, the full programme for anxiety reduction was followed by 20 students, as shown in Table 1.

Table 1. *Participants in the programme for anxiety reduction (eighth-grade students)*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	11	55.0	55.0	55.0
	Female	9	45.0	45.0	100.0
	Total	20	100.0	100.0	

Instrument

The psychological assessment was carried out using the Spence Children's Anxiety Scale (SCAS), adapted and standardized for the Romanian population aged 8–15 by Cognitrom, and included within the Developmental Assessment Platform for ages 6/7–18/19 years (PEDb, Cognitrom). It was developed by Australian Susan H. Spence (1997) for the assessment of six anxiety disorders in children, as presented by the American Psychiatric Association (1994). The scale was initially addressed to children aged 8-12, but it was later calibrated for the age range 8-15 years ("Normative sample"). In other countries, the scale was calibrated for other

age ranges: 7-19 years in the Netherlands, 12-18 years in Belgium, 8-12 years in Germany and Japan ("Normative data"). In Romania, the scale was adjusted and calibrated for the age range 8-15 years by the Cognitrom Company from Cluj-Napoca. The standards were separately designed for boys and girls aged 8-11 years and 12-15 years, using a nonclinical sample of 1583 children (772 boys and 811 girls).

The Spence Children's Anxiety Scale consists of 45 items, of which 38 describe aspects relating to anxiety symptoms and are included in six subscales: generalised anxiety (6 items), panic disorder/agoraphobia (9 items), social phobia (6 items), separation anxiety (6 items), obsessive-compulsive disorder (6 items) and personal injury fears (5 items). A number of 6 items are mainly aimed at reducing the tendency to provide negative responses (for example: "I am good at sports"; "I am proud of my school work"). The last item of the scale was formulated as an open-ended question ("Is there something else that you are really afraid of? Please write down what it is").

In order to interpret the subscale scores obtained by a respondent, raw scores were converted to norm-referenced T-scores. T-scores were interpreted as follows: T-scores less than 60: normal anxiety; T-scores between 60 and 65: at risk for anxiety disorder; T-scores between 65 and 70: close to the clinical level of anxiety disorder; T-scores greater than 70: clinical-level anxiety disorder. Mean differences were statistically processed using SPSS 26.0.

Procedure

The research was conducted over a 3-month period and was divided into three stages:

- initial stage: initial psychological assessment through the administration of the Spence Children's Anxiety Scale, as a self-report measure of anxiety symptoms in adolescent students. It should be noted that the assessment was carried out in the classroom, with each student completing a personal questionnaire;
- intermediate stage: developing and implementing the Intervention Program through recreational sports activities for reducing anxiety in students aged 14–15. Recreational sports activities took place on the schoolyard grounds or in the park near the school. All activities were carried out under the guidance of the qualified teacher;
- final stage: final psychological assessment through the administration of the Spence Children's Anxiety Scale in order to evaluate the level of anxiety among students after completing the intervention program. The scale was also completed in the classroom.

This approach had the following tasks:

- evaluating the level and structure of anxiety in accordance with the dimensions proposed in the DSM-IV Diagnostic and Statistical Manual of Mental Disorders (APA, 1994) – generalized anxiety, panic attack/agoraphobia, social phobia, separation anxiety, obsessive-compulsive disorder, and fear of physical injury – among the research participants, through the administration of the Spence Children's Anxiety Scale.
- determining the participants included in the study;
- knowing the sports activities which are preferred by students in order to implement them in the intervention programme;
- developing and implementing the Intervention Program through recreational sports activities for reducing anxiety;

- evaluating the level and structure of anxiety (generalized anxiety, panic attack/agoraphobia, social phobia, separation anxiety, obsessive-compulsive disorder, and fear of physical injury) among the research participants after the implementation of the Intervention Program through recreational sports activities;
- analysing, interpreting and presenting the results;
- assessing the effect of the intervention program implemented with the research participants on the level and structure of anxiety.

Intervention programme

The designed intervention programme was based on several sports activities and was applied over a period of 3 months with the purpose of reducing anxiety.

The programme consisted of both group and individual activities chosen from the school's curriculum, but also based on students' preferences. Thus, the intervention programme included sports activities played on the schoolyard grounds (football, volleyball, handball) and walks in the park associated with dance and two other sports games preferred by students, namely table tennis and badminton.

The students performed the above-mentioned activities 4 days a week during their free time, immediately after school, as well as on Saturday mornings (Table 2).

Table 2. *Structure of the intervention programme*

Week	Month	Tuesday	Thursday	Friday	Saturday
I	March			•	•
II	March	•	•	•	•
III	March	•	•	•	•
IV	March	•	•	•	•
V	March + April	•	•	•	•
VI	April	•	•		
VII	May	•	•	•	•
VIII	May	•	•	•	•
IX	May	•	•	•	•
X	May	•	•	•	•

It should be noted that the implementation of the intervention programme was facilitated by the fact that the physical education teacher was also the classroom teacher and thus had the instruments and arguments to persuade the students' parents to accept the involvement of their children throughout the programme. In addition, the activities organized by the classroom teacher were free of charge, which attracted even more both the students and their parents who did not have to financially support their children.

The 36 days of activity were spread over three months, overlapping modules 4 and 5 in the school year structure. The two modules were separated by the Easter holiday, but also by a week dedicated to the National "Green Week" programme.

Physical activities lasted 50 to 60 minutes per session, and their aim was to provide participants with relaxation and fun. Sports games were played in opposing teams, which changed from one activity to another. Students were allowed to be team captains one by one and choose their "players".

It is worth mentioning that the main activity was bilateral play, held on regular-sized volleyball court or on small areas (handball and football) throughout the intervention. As in any motor activity, the principle of graded body stress was observed, by warm-up for 5 to 8 minutes/lesson. The means used targeted different variants of walking or running, or exercises for the main parts of the body, the intensity of which did not exceed 75% of HRmax. In the fundamental part of the lesson, we opted exclusively for the bilateral game itself because we took into account the majority preference of the adolescents. Students justified their preference by arguing that the time allocated to the bilateral game in the physical education lessons in the common trunk is insufficient, and the infrastructure existing in the lesson does not meet the standards imposed by the practice of bilateral games. Also, respecting the majority preference of the adolescents led to their active and conscious involvement in the lesson, an important goal in the current educational context. At the end of the lesson, the cool-down was scientifically directed, by means specific to physical education, the intensity of which ensured the decrease of the values of the main functional parameters – heart rate and respiratory frequency. The duration of that part was 5 minutes/lesson. The game of badminton, held in the open air, respectively in the park, aimed at relaxation, inducing well-being and did not have as main objective learning specific motor skills. Instead, the rules associated with physical effort were observed, namely gradual request, optimal request and cool-down.

The marked trails in the park were used for walking, and the dance moments enabled children to use their creativity to the music of their favourite artists. No movement idea was rejected, and students were encouraged to create individual choreography pieces that all their peers had to perform on a previously established date that was known to everyone. Through this approach, all students were put in the situation of being leaders several times, which enabled them to feel better and appreciated by their peers, helped them to stand out and exploit their artistic skills. All these aspects were facilitated by the fact that the group members had known each other for a long time, so they were able to work together and express themselves freely when put in different real-life situations.

Physical activities, the same throughout the weeks, were distributed within the intervention programme as follows (Table 3): lesson 1: football for boys and volleyball for girls; lesson 2: walk in the park and table tennis; choreography/dance; lesson 3: walk in the park and badminton; lesson 4: football for boys and handball for girls.

Table 3. *Distribution of physical activities by week, day and content*

Week	Month	Tuesday	Thursday	Friday	Saturday
I	March	-	-	B+W	F+H
II	March	F+V	T+W+D	B+W	F+H
III	March	F+V	T+W+D	B+W	F+H
IV	March	F+V	T+W+D	B+W	F+H
V	March + April	F+V	T+W+D	B+W	F+H
VI	April	F+V	T+W+D	-	-
VII	May	F+V	T+W+D	B+W	F+H
VIII	May	F+V	T+W+D	B+W	F+H
IX	May	F+V	T+W+D	B+W	F+H
X	May	F+V	T+W+D	B+W	F+H

Note: football = F; volleyball = V; walk in the park = W; table tennis = T; choreography/dance = D; badminton = B; handball = H.

Results

Generalised anxiety

The level of generalised anxiety decreased by 0.30 in the final testing, namely from 11.45 to 11.15. The results indicated that the level of generalised anxiety was relatively elevated among students, which was normal if we take into account the major significance of the upcoming exam. The important thing was that the implemented programme had beneficial effects, since the level of generalised anxiety was lower in the final testing.

The statistical interpretation of the data obtained in the two testing sessions for generalised anxiety (t-Test: Paired Two Sample for Means) is shown in Table 4.

Table 4. *t-Test results for generalised anxiety*

	Initial test	Final test
Mean	11.45	11.15
Df	19	
t Stat	-4.021	
P(T<=t) two-tail	0.64	

After applying the *t*-Test, a p-value of 0.64 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Panic disorder

The initial testing results indicated a minimum value of 9, a maximum value of 15, and a mean score of 11.5. Therefore, the investigated students had a relatively normal level of panic disorder. Similarly, a decrease in the mean score obtained by students was observed in the final testing. The difference of 0.8 points revealed a lower level of panic disorder after completing the physical activity programme.

The statistical interpretation of the data obtained in the two testing sessions for panic disorder (*t*-Test: Paired Two Sample for Means) is shown in Table 5.

Table 5. *t-Test results for panic disorder*

	Initial test	Final test
Mean	11.50	10.70
Df	19	
t Stat	-1.224	
P(T<=t) two-tail	0.235	

After applying the *t*-Test, a p-value of 0.23 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Social phobia

Participants obtained a mean score of 12.45 for this item in the initial testing, which indicated a normal level of social phobia, while students did not show relevant symptoms of this disorder. An important decrease in social phobia was recorded in the final testing. The decrease was 1.40 points, which revealed that recreational sports activities reduced the symptoms of social phobia that eighth graders might have. Thus, group activities contributed to improving social relationships and eliminating fears.

The statistical interpretation of the data obtained in the two testing sessions for social phobia (*t*-Test: Paired Two Sample for Means) is shown in Table 6.

Table 6. *t-Test results for social phobia*

	Initial test	Final test
Mean	12.45	11.05
Df	19	
t Stat	-4.154	
P(T<=t) two-tail	0.537	

After applying the *t*-Test, a p-value of 0.53 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Separation anxiety

The mean score obtained in the initial testing was 10.70 points, which indicated a relatively normal level of separation anxiety among the investigated students. They showed no signs of separation anxiety, according to their scores. In the final testing, the level of separation anxiety decreased by 0.7 points, highlighting that recreational sports activities relieved the symptoms related to separation anxiety and had beneficial effects in this regard.

The statistical interpretation of the data obtained in the two testing sessions for separation anxiety (*t*-Test: Paired Two Sample for Means) is shown in Table 7.

Table 7. *t-Test results for separation anxiety*

	Initial test	Final test
Mean	10.70	10.00
Df	19	
t Stat	-7.24883	
P(T<=t) two-tail	0.073103	

After applying the *t*-Test, a p-value of 0.07 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Obsessive-compulsive disorder

Regarding obsessive-compulsive disorder, students obtained the lowest mean score among the items listed so far, namely 8.3. In the final testing, a smaller decrease was found, which suggests that participation in the recreational sports activities included in the intervention programme had a relatively low effect on this item.

The statistical interpretation of the data obtained in the two testing sessions for obsessive-compulsive disorder (*t*-Test: Paired Two Sample for Means) is shown in Table 8.

Table 8. *t-Test results for obsessive-compulsive disorder*

	Initial test	Final test
Mean	8.30	8.20
Df	19	
t Stat	-10.687	
P(T<=t) two-tail	0.785	

After applying the *t*-Test, a p-value of 0.78 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Personal injury fears

The mean score was 8.10 points in the initial testing, while at the final testing the score emphasised the most significant decrease, 2.1 points, which leads us to state that the implemented programme contributed to reducing personal injury fears.

The statistical interpretation of the data obtained in the two testing sessions for personal injury fears (*t*-Test: Paired Two Sample for Means) is shown in Table 9.

Table 9. *t-Test results for personal injury fears*

	Initial test	Final test
Mean	8.10	6.00
Df	19	
t Stat	-12.1186	
P(T<=t) two-tail	0.939009	

After applying the *t*-Test, a p-value of 0.93 was found, indicating a statistically insignificant difference between the results of the two testing sessions.

Anxiety level

The mean score obtained by students was 62.75, suggesting a risk for anxiety disorder. The final testing results revealed a moderate level of anxiety, which decreased to 57.1 points. After completion of the sports activity programme, the overall level of anxiety was $T \leq 60$, indicating a normal anxiety level.

It should be considered that no immediate changes can occur in the case of anxiety disorders. Therefore, participation in sports activity programmes needs to last longer to see significant changes. In this study, the changes were small, but the prophylactic effects were visible.

Discussion and Conclusion

Adolescence is widelyrecognised as a particularly vulnerable period (Ho et al., 2015) associated with the development of mental health disorders, with anxiety disorders being the most common diagnosis (Kim-Cohen et al., 2003). The frequency of these disorders has increased significantly in recent years and continues to increase all over the world (Li et al., 2024; Li et al., 2021).

Although emotional disorders have negative consequences on the quality of life, well-being and development of adolescents, they are the least identified mental health issues, placing them at risk for the occurrence of related problems. Studies addressing adolescent problems have shown associations between sports activity and stress, anxiety, depression, and mood (Bae et al., 2024; Bang et al., 2024). The impact of the benefits induced by sports activity differs, with some specialists mentioning important gains, and others identifying only small improvements (Lubans et al., 2016; Rodriguez-Ayllon et al., 2019). All this could be also observed after the implementation of our intervention programme. However, sports activities are important protective factors for at-risk adolescents (Brière et al., 2018). Ideally, adolescents should not develop anxiety disorders, and prevention at the age of 14-16 plays a major role (Guddal et al., 2019).

Sports activities can be played outside of the regular school schedule (extracurricular activities) or during free time; they are coordinated by a specialist or may not be connected to academic learning. Extracurricular sports activities have the potential to reduce anxiety disorders because they offer adolescents the opportunity to play their favourite sport, acquire new knowledge and skills, and make new friends (Oberle et al., 2019). These activities have been found to be more effective when performed at moderate or high intensity (White et al., 2024). Feng et al. (2024), Graupensperger et al. (2021) and Wang et al. (2020) have shown that recreational sports activities reduce anxiety symptoms, protecting physical and mental health.

Sports activities carried out by adolescents together with peers (classmates, schoolmates, or even friends), under the coordination of a specialist, have a greater impact on their mental health because school is the social environment where they spend most of their time. To be appreciated by peers is highly beneficial; moreover, to be included in school teams and participate in sports competitions induces a sense of belonging, self-confidence and achievement (Bang et al., 2024).

The results of our study indicate that adolescents enjoy participating when physical activities are chosen by themselves, when they know the technique, tactics and regulations of the sports concerned and have the opportunity to consolidate and improve the skills learned with their peers. Students were able to better observe themselves in situations different from those encountered in school classes, which allowed them to make new friends or strengthen existing friendships.

There are different opinions about performing individual or team sports activities. According to some studies, sports activities have a direct influence on reducing anxiety, whether they are played individually or in a team (Vella et al., 2023; Vella et al., 2017). Other specialists believe that individual and team sports do not have the same impact on reducing anxiety disorders. Thus, it is considered that playing sports games is more beneficial for anxiety reduction (Graupensperger et al., 2021) due to the relationships they develop (Bang et al., 2024), the support provided by peers in different situations that arise (Clément et al., 2024; Graupensperger et al., 2021), the constant feedback received (Doré et al., 2020), the feeling of social acceptance and the improvement of self-image (Bang et al., 2024). It has been found that boys prefer sports games (Bang et al. 2024; Bradley et al., 2000) because they are more attached to the team to which they belong, while girls prefer games where there is no physical contact between opponents, more specifically, volleyball (Bradley et al., 2000). This preference was also highlighted in our study by the fact that girls chose to play volleyball once a week to the detriment of the game of football or handball where physical contact is obvious.

An important aspect regarding the possibilities of reducing anxiety disorders through sports activities is the length of time adolescents have been involved in playing them. The study by Ashdown-Franks et al. (2017) emphasised that a greater number of years of team sports participation was associated with fewer symptoms of panic disorder.

Adolescents who play individual sports may also gain benefits for their mental health (Bang et al., 2024), but these depend on each person's preferences, personality traits and hormonal factors (Eddolls et al., 2018), as well as on gender differences, with girls opting for individual sports more than boys (Bradley et al., 2000). In terms of adolescent gender, anxiety disorders can be found in both girls and boys. However, anxiety seems to be more common in girls (Bang et al., 2024; Graupensperger et al., 2021). Female adolescents are more sedentary and less competitive (Bradley et al., 2000), while male adolescents are more involved in sports activities (Halliday et al., 2019), being interested in intense, physically demanding activities and sports games (Bradley et al., 2000). At the same time, adolescent girls who play individual sports are more likely to experience anxiety-related problems compared to those playing team sports, but these differences do not exist in boys (Graupensperger et al., 2021).

The findings suggest that sports activities produce better effects if performed in the natural environment whose impact on anxiety has already been demonstrated (Cox et al., 2017; Dzhambov et al., 2019). This idea is reinforced by Vella et al. (2023), who also support the positive impact of sports activities carried out outside. For this reason, our study combined physical activities carried out in the park (which was behind the school) – walking, table tennis, badminton, dancing, with those organized in the school yard or in the physical education room.

Some adolescents suffer from social phobia (Woodward & Fergusson, 2001), an exaggerated and constant fear of getting involved in social situations or activities. Fear occurs when the individual comes into contact with unknown people or is exposed to the control of others. Sports activities make it easier for adolescents to cope with these situations, reducing social anxiety (Doré et al., 2020; Graupensperger et al., 2021). The composition of teams or individual participants in different sports activities is/are permanently changing, which is why adolescents are put in the situation of constantly interacting with people of the same or different ages, of the same or different genders. It is obvious that sports games help reduce social anxiety (Graupensperger et al., 2021), but the contribution of individual sports should not be neglected.

This aspect is highlighted by Ashdown-Franks et al. (2017), who found that playing individual sports for a longer period of time led to a reduction in social phobia symptoms.

Adolescent girls have more social anxiety disorders (Feng et al., 2024), but involvement in recreational sports activities associated with other leisure-time activities such as reading, painting, creative drama, etc. can be effective in reducing social phobia (Karagün et al., 2010).

In terms of exercise intensity, opinions are divided. Some studies emphasise the benefits of vigorous sports activities (Costigan et al., 2015; Gerber et al., 2015), while others claim that low- and moderate-intensity activities would have positive effects (Eddolls et al., 2017). The latter argue that vigorous sports activities facilitate the development of anxiety due to the impossibility of achieving goals and the large amount of exercise that is intended to be achieved. The limited time available to some adolescents for sports activities does not allow them to reach the proposed objectives, which negatively influences anxiety disorders. Swann et al. (2024) state that goal setting for sports activities aimed at people with anxiety disorders should be carefully done and take into account their level of engagement in physical activity. Most adolescents are active (González-Hernández et al., 2019; Li et al., 2024), which leads to improved motor skills and maintenance of mental and functional health. Less active adolescents may be vulnerable; for them, the risk should be minimised and the benefits maximised (Swann et al., 2024). Instead, organized movement can reduce inattention and impulsivity in hyperactive adolescents (Graupensperger et al., 2021).

Other studies have shown that aerobic sports activities improve cognitive health in adolescents (Abrantes et al., 2019; Costigan et al., 2016; Zink et al., 2020). According to Bernstein and McNally (2017), moderate-intensity aerobic exercise reduces anxiety symptoms due to cumulative recurrent mood improvements. Dale et al. (2019) reinforce the idea of using aerobic sports activities, mentioning that this type of exercise should be done on a regular basis.

Adolescents who are involved in recreational sports activities at least three times a week report fewer anxiety disorders compared to their peers who do not participate in such activities (Chi & Wang, 2022). If vigorous-intensity exercise is performed three times a week for 20 minutes, significant improvements in mental health will be achieved (Gerber et al., 2014). After associating exercise intensity with the frequency of sports activities performed during a week, Rees and Sabia (2010) recommended a higher frequency of moderate-intensity sports activities. It should be considered that weekly participation in too many intense sports activities requiring elaborate technique and complex tactical strategies may lead to overtraining and more severe anxiety states (Graupensperger et al., 2021) or even burnout (Li et al., 2021).

All adolescents, whether with or without disabilities, should be involved in sports activities (Essau et al., 2012). Ideally, these activities should be individualised (Graupensperger et al., 2021) and performed for a long time, both throughout adolescence (Guddal et al., 2019) and beyond. Programme individualisation by gender was also related to how adolescents perceived their own bodies. Participation in sports activities induced greater positive effects among boys (Riddervold et al., 2023), while girls reported greater dissatisfaction with their own bodies (Gomez-Baya, 2017), which led them to give up engaging in such activities (Meyer et al., 2023). It is important to help adolescents understand the role of sports activities in forming a correct body image, as well as reducing stress and anxiety disorders (Jia & Gao, 2024).

Limitations of our approach: the small number of participants who attended all organized physical activities and the short duration of the intervention programme (3 months), which led to improvements, but not to statistically significant differences in anxiety levels.

This study has demonstrated that recreational sports activities have beneficial effects on anxiety disorders. The proposed intervention programme, which was coordinated by a physical education teacher, produced some effects in terms of decreasing the level of anxiety among adolescents. Therefore, the recreational sports activity programme was effective because it reduced the overall level of anxiety in eighth-grade students.

Although the intervention produced modest, non-significant changes, the findings support the potential of recreational sports activities as a preventive strategy for anxiety reduction among adolescents.

Authors' Contributions: The third author had an equal contribution to the publication as the first author.

Acknowledgement: The authors would like to thank all participants involved in this study.

Funding: This research did not receive any external funding.

Institutional Review Board Statement: We received the agreement of the Ethics Committee for Research-Development-Innovation of UNEFS Bucharest, no. 41/15.01.2025

Informed Consent Statement: Written informed consent was obtained for all participants involved in this study.

Data Availability Statement: Data can be made available upon request to the contact author.

Conflicts of Interest: The authors declare no conflict of interest.

References

Abrantes, A. M., Farris, S. G., Brown, R. A., Greenberg, B. D., Strong, D. R., McLaughlin, N. C., & Riebe, D. (2019). Acute effects of aerobic exercise on negative affect and obsessions and compulsions in individuals with obsessive-compulsive disorder. *Journal of Affective Disorders, 245*, 991-997. https://doi.org/10.1016/j.jad.2018.11.074

Antony, M. M., & Stein, M. B. (2008). *Oxford handbook of anxiety disorders*. Oxford University Press.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). American Psychiatric Publishing, Inc.

Ashdown-Franks, G., Sabiston, C. M., Solomon-Krakus, S., & O'Loughlin, J. L. (2017). Sport participation in high school and anxiety symptoms in young adulthood. *Mental Health and Physical Activity, 12*, 19-24. https://doi.org/10.1016/j.mhpa.2016.12.001

Bae, M.-H., Zhang, X., & Lee, J.-S. (2024). Exercise, grit, and life satisfaction among Korean adolescents: A latent growth modeling analysis. *BMC Public Health, 24*(1): 1392. https://doi.org/10.1186/s12889-024-18899-8

Bang, H., Chang, M., & Kim, S. (2024). Team and individual sport participation, school belonging, and gender differences in adolescent depression. *Children and Youth Services Review, 159*: 107517. https://doi.org/10.1016/j.childyouth.2024.107517

Bernstein, E. E., & McNally, R. J. (2017). Acute aerobic exercise hastens emotional recovery from a subsequent stressor. *Health Psychology, 36*(6), 560-567. https://doi.org/10.1037/hea0000482

Bouchard, C., Blair, S., & Haskell, W. (2012). *Physical activity and health.* Human Kinetics.

Bradley, C. B., McMurray, R. G., Harrell, J. S., & Deng, S. (2000). Changes in common activities of 3rd through 10th graders: The CHIC study. *Medicine & Science in Sports & Exercise, 32*(12), 2071-2078. https://doi.org/10.1097/00005768-200012000-00017

Brière, F. N., Yale-Soulière, G., González-Sicilia, D., Harbec, M. J., Morizot, J., Janosz. M., & Pagani, L. S. (2018). Prospective associations between sport participation and psychological adjustment in adolescents. *Journal of Epidemiology & Community Health, 72*(7), 575-581. https://doi.org/10.1136/jech-2017-209656

Chi, G., & Wang, L. (2022). The association of sports participation with depressive symptoms and anxiety disorder in adolescents. *Frontiers in Public Health, 10*: 860994. https://doi.org/10.3389/fpubh.2022.860994

Chiu, A., Falk, A., & Walkup, J. T. (2015). Anxiety disorders among children and adolescents. *Focus, 14*(1), 26-33. https://doi.org/10.1176/appi.focus.20150029

Clément, J.-F., Gallant, F., Hudon, C., Montiel, C., Riglea, T., Berbiche, D., Doré, I., Sylvestre, M.-P., O'Loughlin, J., & Bélanger, M. (2024). Use of physical activity as a coping strategy mediates the association between adolescent team sports participation and emerging adult mental health. *Mental Health and Physical Activity, 27*: 100612. https://doi.org/10.1016/j.mhpa.2024.100612

Costigan, S. A., Eather, N., Plotnikoff, R. C., Hillman, C. H., & Lubans, D. R. (2016). High-intensity interval training for cognitive and mental health in adolescents. *Medicine & Science in Sports & Exercise, 48*(10), 1985-1993. https://doi.org/10.1249/mss.0000000000000993

Costigan, S. A., Lubans, D. R., Lonsdale, C., Sanders, T., & Del Pozo Cruz, B. (2015). Associations between physical activity intensity and well-being in adolescents. *Preventive Medicine, 125*, 55-61. https://doi.org/10.1016/j.ypmed.2019.05.009

Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., Anderson, K., Hancock, S., & Gaston, K. J. (2017). Doses of neighborhood nature: The benefits for mental health of living with nature. *BioScience, 67*(2), 147-155. https://doi.org/10.1093/biosci/biw173

Dale, L. P., Vanderloo, L., Moore, S., & Faulkner, G. (2019). Physical activity and depression, anxiety and self-esteem in children and youth: An umbrella systematic review. *Mental Health and Physical Activity, 16*, 66-79. https://doi.org/10.1016/j.mhpa.2018.12.001

DeWolfe, C. E., Watt, M. C., Romero-Sanchiz, P., & Stewart, S. H. (2020). Gender differences in physical activity are partially explained by anxiety sensitivity in post-secondary students. *Journal of American College Health, 68*(3), 219-222. https://doi.org/10.1080/07448481.2018.1549048

Doré, I., Sylvester, B., Sabiston, C., Sylvestre, M.-P., O'Loughlin, J., Brunet, J., & Bélanger, M. (2020). Mechanisms underpinning the association between physical activity and mental health in adolescence: A 6-year study. *International Journal of Behavioral Nutrition and Physical Activity, 17*(1): 9. https://doi.org/10.1186/s12966-020-0911-5

Dzhambov, A. M., Hartig, T., Tilov, B., Atanasova, V., Makakova, D. R., & Dimitrova, D. D. (2019). Residential greenspace is associated with mental health via intertwined capacity-building and capacity-restoring pathways. *Environmental Research, 178*: 108708. https://doi.org/10.1016/j.envres.2019.108708

Eddolls, W. T. B., McNarry, M. A., Stratton, G., Winn, C. O. N., & Mackintosh, K. A. (2017). High-intensity interval training interventions in children and adolescents: A systematic review. *Sports Medicine, 47*(11), 2363-2374. https://doi.org/10.1007/s40279-017-0753-8

Eddolls, W. T. B., McNarry, M. A., Lester, L., Winn, C. O. N., Stratton, G., & Mackintosh, K. A. (2018). The association between physical activity, fitness and body mass index on mental well-being and quality of life in adolescents. *Quality of Life Research, 27*(9), 2313-2320. https://doi.org/10.1007/s11136-018-1915-3

Essau, C. A., Conradt, J., Sasagawa, S., & Ollendick, T. H. (2012). Prevention of anxiety symptoms in children: Results from a universal school-based trial. *Behavior Therapy, 43*(2), 450-564. https://doi.org/10.1016/j.beth.2011.08.003

Ezpeleta, L., Keeler, G., Erkanli, A., Costello, E. J., & Angold, A. (2001). Epidemiology of psychiatric disability in childhood and adolescence. *The Journal of Child Psychology and Psychiatry, 42*(7), 901-914. https://doi.org/10.1111/1469-7610.00786

Feng, W., Zhao, L., Ge, Z., Zhao, X., Li, T., & Zhu, Q. (2024). Association between physical activity and adolescent mental health in the post COVID-19: The chain mediating effect of self-esteem and social anxiety. *PLoS One, 19*(5): e0301617. https://doi.org/10.1371/journal.pone.0301617

Gerber, M., Brand, S., Herrmann, C., Colledge, F., Holsboer-Trachsler, E., & Pühse, U. (2014). Increased objectively assessed vigorous-intensity exercise is associated with reduced stress, increased mental health and good objective and subjective sleep in young adults. *Physiology & Behavior, 135*, 17-24. https://doi.org/10.1016/j.physbeh.2014.05.047

Gerber, M., Lindwall, M., Brand, S., Lang, C., Elliot, C., & Pühse, U. (2015). Longitudinal relationships between perceived stress, exercise self-regulation and exercise involvement among physically active adolescents. *Journal of Sports Sciences, 33*(4), 369-380. https://doi.org/10.1080/02640414.2014.946072

Gomez-Baya, D., Mendoza, R., Gaspar de Matos, M., & Tomico, A. (2019). Sport participation, body satisfaction and depressive symptoms in adolescence: A moderated-mediation analysis of gender differences. *European Journal of Developmental Psychology, 16*(2), 183-197. https://doi.org/10.1080/17405629.2017.1364988

González-Hernández, J., Gómez-López, M., Pérez-Turpin, J. A., Muñoz-Villena, A. J., & Andreu-Cabrera, E. (2019). Perfectly active teenagers. When does physical exercise help psychological well-being in adolescents? *International Journal of Environmental Research and Public Health, 16*(22): 4525. https://doi.org/10.3390/ijerph16224525

Graupensperger, S., Sutcliffe, J., & Vella, S. A. (2021). Prospective associations between sport participation and indices of mental health across adolescence. *Journal of Youth and Adolescence, 50*(7), 1450-1463. https://doi.org/10.1007/s10964-021-01416-0

Guddal, M. H., Stensland, S. Ø., Cvancarova Smastuen, M., Bakke Johnsen, M., Zwart, J.-A., & Storheim, K. (2019). Physical activity and sport participation among adolescents: Associations with mental health in different age groups. Results from the Young-HUNT study: A cross-sectional survey. *BMJ Open, 9*(9): e028555. https://doi.org/10.1136/bmjopen-2018-028555

Guthold, R., Stevens, G., Riley, L., & Bull, F. (2019). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1·6 million participants. *The Lancet Child & Adolescent Health, 4*(1), 23-35. https://doi.org/10.1016/s2352-4642(19)30323-2

Halliday, A. J., Kern, M. L., & Turnbull, D. A. (2019). Can physical activity help explain the gender gap in adolescent mental health? A cross-sectional exploration. *Mental Health and Physical Activity, 16*, 8-18. https://doi.org/10.1016/j.mhpa.2019.02.003

Ho, F. K.W., Louie, L. H. T., Chow, C. B., Wong, W. H. S., & Ip, P. (2015). Physical activity improves mental health through resilience in Hong Kong Chinese adolescents. *BMC Pediatrics, 15*: 48. https://doi.org/10.1186/s12887-015-0365-0

Jia, Y., & Gao, X. (2024). A chained mediator model: The effect of physical activity on negative emotions in obese adolescents. *Gazzetta Medica Italiana – Archivio per le Scienze Mediche, 183*(3), 146-153. http://dx.doi.org/10.23736/S0393-3660.23.05123-9

Karagün, E., Yıldız, M., Basaran, Z., & Çağlayan, Ç. (2010). The effect of recreational activities on phobic attitudes of the university students with social phobia: A comparative study. *Anatolian Journal of Psychiatry, 11*(2), 139-144.

Kim-Cohen, J., Caspi, A., Moffitt, T. E., Harrington, H., Milne, B. J., & Poulton, R., (2003). Prior juvenile diagnoses in adults with mental disorder: Developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry, 60*(7), 709-717. https://doi.org/10.1001/archpsyc.60.7.709

Lawton, E., Brymer, E., Clough, P., & Denovan, A. (2017). The relationship between the physical activity environment, nature relatedness, anxiety, and the psychological well-being benefits of regular exercisers. *Frontiers in Psychology, 8*: 1058. https://doi.org/10.3389/fpsyg.2017.01058

Li, W., Gao, Y., Liu, G., Hao, R., Zhang, M., & Li, X. (2024). Shifting the paradigm: A fresh look at physical activity frequency and its impact on mental health, life satisfaction, and self-rated health in adolescents. *International Journal of Mental Health Promotion, 26*(2), 83-92. http://dx.doi.org/10.32604/ijmhp.2023.042014

Li, Y., Sun, Q., Sun, M., Sun, P., Sun, Q., & Xia, X. (2021). Physical exercise and psychological distress: The mediating roles of problematic mobile phone use and learning burnout among adolescents. *International Journal of Environmental Research and Public Health, 18*(17): 9261. https://doi.org/10.3390/ijerph18179261

Lubans, D., Richards, J., Hillman, C., Faulkner, G., Beauchamp, M., Nilsson, M., Kelly, P., Smith, J., Raine, L., & Biddle, S. (2016). Physical activity for cognitive and mental health in youth: A systematic review of mechanisms. *Pediatrics, 138*(3): e20161642. https://doi.org/10.1542/peds.2016-1642

Ma, W.F, Yen, W.J., Chen, W.C., Chang, H.J., Huang, X.Y., & Lane, H.Y. (2009). Roles of state and trait anxiety in physical activity participation for adults with anxiety disorders. *Journal of the Formosan Medical Association, 108*(6), 481-492. https://doi.org/10.1016/S0929-6646(09)60096-6

Martinsen, E.W. (2008). Physical activity in the prevention and treatment of anxiety and depression. *Nordic Journal of Psychiatry, 62*(47), 25-29. https://doi.org/10.1080/08039480802315640

Mc Dowell, C. P., Carlin, A., Capranica, L., Dillon, C., Harrington, J. M., Lakerveld, J., Loyen, A., Ling, F. C. M., Brug, J., MacDonncha, C., & Herring, M. P. (2018). Associations of self-reported physical activity and depression in 10,000 Irish adults across harmonised datasets: A DEDIPAC-study. *BMC Public Health, 18*(1): 779. https://doi.org/10.1186/s12889-018-5702-4

Melguizo-Ibáñez, E., Zurita-Ortega, F., Ubago-Jiménez, J. L., Puertas-Molero, P., & González-Valero, G. (2022). Motivational climate, anxiety and physical self-concept in trainee physical education teachers: An explanatory model regarding physical activity practice time. *International Journal of Environmental Research and Public Health, 19*(9): 12812. https://doi.org/10.3390/ijerph191912812

Merikangas, K. R., He, J.-P., Burstein, M., Swendsen, J., Avenevoli, S., Case, B., Georgiades, K., Heaton, L., Swanson, S., & Olfson, M. (2011). Service utilization for lifetime mental disorders in U.S. adolescents: Results of the National Comorbidity Survey-Adolescent

Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(1), 32-45. https://doi.org/10.1016/j.jaac.2010.10.006

Meyer, S., Lang, C., Ludyga, S., Grob, A., & Gerber, M. (2023). "What if others think I look like..." The moderating role of social physique anxiety and sex in the relationship between physical activity and life satisfaction in Swiss adolescents. *International Journal of Environmental Research and Public Health, 20*(5): 4441. https://doi.org/10.3390/ijerph20054441

Ministerul Educației și Cercetării. (2024). *Evaluarea Națională a absolvenților clasei a VIII-a* [National Evaluation of eighth-grade students]. https://www.edu.ro/evaluare_nationala_ENVIII

Mocanu, G. D. (2018). *Loisir/Activități motrice de timp liber* [Recreational sports activities]. Galați University Press.

Oberle, E., Ji, X. R., Guhn, M., Schonert-Reichl, K. A., & Gadermann, A. M. (2019). Benefits of extracurricular participation in early adolescence: Associations with peer belonging and mental health. *Journal of Youth and Adolescence*, *48*(11), 2255-2270. https://doi.org/10.1007/s10964-019-01110-2

Oeland, A. M., Laessoe, U., Olesen, A. V., & Munk-Jørgensen, P. (2010). Impact of exercise on patients with depression and anxiety. *Nordic Journal of Psychiatry, 64*(3), 210-217. https://doi.org/10.3109/08039480903511373

Panza, M. J., Graupensperger, S., Agans, J. P., Doré, I., Vella, S. A., & Evans, M. B. (2020). Adolescent sport participation and symptoms of anxiety and depression: A systematic review and meta-analysis. *Journal of Sport and Exercise Psychology, 42*(3), 201-218. https://doi.org/10.1123/jsep.2019-0235

Petzold, M. B., Bendau, A., & Stroehle, A., Physical activity in the prevention and treatment of anxiety disorders. *Psychotherapeut, 63*(3), 135-142. https://doi.org/10.1007/s00278-020-00414-0

Qin, T., Chen, P., Wang, J., Dong, J., & Zhang, K. (2024). Impact of physical activity on anxiety among university students: a moderated mediation model. *Frontiers in Psychology*, *15*: 1509201. https://doi.org/10.3389/fpsyg.2024.1509201

Rahmati, M., Lee, S., Yon, D. K., Lee, S. W., Udeh, R., McEvoy, M., Oh, H., Butler, L., Keyes, H., Barnett, Y., Koyanagi, A., Shin, J. I., & Smith, L. (2024). Physical activity and prevention of mental health complications: An umbrella review. *Neuroscience & Biobehavioral Reviews*, *160*: 105641. https://doi.org/10.1016/j.neubiorev.2024.105641

Riddervold, S., Haug, E., & Kristensen, S. M. (2023). Sports participation, body appreciation and life satisfaction in Norwegian adolescents: A moderated mediation analysis. *Scandinavian Journal of Public Health, 52*(6), 704-710. https://doi.org/10.1177/14034948231184525

Rees, D. I., & Sabia, J. J. (2010). Exercise and adolescent mental health: New evidence from longitudinal data. *The Journal of Mental Health Policy and Economics, 13*(1), 13-25.

Rodriguez-Ayllon, M., Cadenas-Sanchez, C., Estevez-Lopez, F., Munoz, N. E., Mora-González, J., Migueles, J. H., Molina-Garcia, P., Henriksson, H., Mena-Molina, A., Martinez-Vizcaino, V., Catena, A., Lof, M., Erickson, K. I., Lubans, D. R., Ortega, F. B., & Esteban-Cornejo, I. (2019). Role of physical activity and sedentary behavior in the mental health of preschoolers, children and adolescents: A systematic review and meta-analysis. *Sports Medicine, 49*(9), 1383-1410. https://doi.org/10.1007/s40279-019-01099-5

Sawyer, M. G., Reece, C. E., Sawyer, A. C. P., Hiscock, H., & Lawrence, D. (2019). Adequacy of treatment for child and adolescent mental disorders in Australia: A national study. *Australian and New Zealand Journal of Psychiatry, 53*(4), 326-335. https://doi.org/10.1177/0004867418808895

Spence, S. H. (1997). *Spence Children's Anxiety Scale (SCAS)* [Database record]. APA PsycTests. https://doi.org/10.1037/t10518-000

Swann, C., Wagner, D., Clarke, M. M., Goddard, S. G., McKeon, G., Rosenbaum, S., Vella, S. A., & Teychenne, M. (2024). Is there a need for mental health informed goal setting in physical activity? *Mental Health and Physical Activity, 27*: 100648. https://doi.org/10.1016/j.mhpa.2024.100648

Tudor, V., Bălan, V., Vărzaru, C., Ticală, L., Lăzărescu, S., Tudor, A. C., Stoica, C., & Mujea, A. M. (2025). Considerations regarding the role of the physical education teacher in promoting proactive behavior among middle school pupils. *Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health, 25*(2), 275-281.

Tudor, V., Vărzaru, C., Ticală, L., Lăzărescu, S., Constantinescu, D., Cîrjaliu, M., Tudor, A., & Mujea, A. M. (2025). Theoretical and practical considerations regarding the proactive and sedentary behavior of middle school pupils. *Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health, 25*(2), 282-293.

Vella, S. A., Swann, C., Allen, M. S., Schweickle, M. J., & Magee, C. A. (2017). Bidirectional associations between sport involvement and mental health in adolescence. *Medicine and Science in Sports and Exercise, 49*(4), 687-694. https://doi.org/10.1249/mss.0000000000001142

Vella, S. A., Sutcliffe, J. T., Fernandez, D., Liddelow, C., Aidman, E., Teychenne, M., Smith, J. J., Swann, C., Rosenbaum, S., White, R., & Lubans, D. R. (2023). Context matters: A review of reviews examining the effects of contextual factors in physical activity interventions on mental health and wellbeing. *Mental Health and Physical Activity, 25*: 100620. https://doi.org/10.1016/j.mhpa.2023.100520

Wang, G.-H., Li, W.-D., & Dou, K. (2020). Extracurricular sports participation increases life satisfaction among Chinese adolescents: A moderated mediation model. *Social Behavior and Personality, 48*(8): e8993. http://dx.doi.org/10.2224/sbp.8993

White, R. L., Vella, S., Biddle, S., Sutcliffe, J., Guagliano, J. M., Uddin, R., Burgin, A., Apostolopoulos, M., Nguyen, T., Young, C., Taylor, N., Lilley, S., & Teychenne, M. (2024). Physical activity and mental health: A systematic review and best-evidence synthesis of mediation and moderation studies. *International Journal of Behavioral Nutrition and Physical Activity, 21*(1): 134. https://doi.org/10.1186/s12966-024-01676-6

Wipfli, B. M., Rethorst, C. D., & Landers, D. M. (2008). The anxiolytic effects of exercise: A meta-analysis of randomized trials and dose-response analysis. *Journal of Sport and Exercise Psychology, 30*(4), 392-410. https://doi.org/10.1123/jsep.30.4.392

World Health Organization. (n.d.). *WHO guidelines on physical activity and sedentary behaviour*. https://iris.who.int/server/api/core/bitstreams/faa83413-d89e-4be9-bb01-b24671aef7ca/content

Woodward, L. J., & Fergusson, D. M. (2001). Life course outcomes of young people with anxiety disorders in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(9): 1086-1093. https://doi.org/10.1097/00004583-200109000-00018

You, S., Shin, K., & Kim, M. (2021). Long-term effect of physical activity on internalizing and externalizing problems and life satisfaction. *Sustainability, 13*(4): 2322. https://doi.org/10.3390/su13042322

Zink, J., Belcher, B. R., Imm, K., & Leventhal, A. M. (2020). The relationship between screen-based sedentary behaviors and symptoms of depression and anxiety in youth: A systematic review of moderating variables. *BMC Public Health, 20*(1): 472. https://doi.org/10.1186/s12889-020-08572-1